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07/743,383 08/21/91 KONNO

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GOUDREAU, G

NAKIAIDO, MARMELSTIEN, MURRAY & ORAM
METRO SQUARE
655 15TH ST, N.W.
SUITE 330-G ST. LOBBY
WASH., D.C. 20005-5701

1104

10/05/92

☒ This application has been examined ☐ Responsive to communication filed on _____ ☐ This action is made final.

A shortened statutory period for response to this action is set to expire 3 month(s), _____ days from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

- | | |
|---|---|
| 1. <input checked="" type="checkbox"/> Notice of References Cited by Examiner, PTO-892. | 2. <input checked="" type="checkbox"/> Notice re Patent Drawing, PTO-948. |
| 3. <input checked="" type="checkbox"/> Notice of Art Cited by Applicant, PTO-1449. | 4. <input type="checkbox"/> Notice of Informal Patent Application, Form PTO-152 |
| 5. <input type="checkbox"/> Information on How to Effect Drawing Changes, PTO-1474. | 6. <input type="checkbox"/> _____ |

Part II SUMMARY OF ACTION

1. ☒ Claims 1-22 are pending in the application.
Of the above, claims _____ are withdrawn from consideration.
2. ☐ Claims _____ have been cancelled.
3. ☒ Claims 11-19 are allowed.
4. ☒ Claims 1-10, 20-22 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ Claims _____ are subject to restriction or election requirement.
7. ☐ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
8. ☐ Formal drawings are required in response to this Office action.
9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable; ☐ not acceptable (see explanation or Notice re Patent Drawing, PTO-948).
10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____, has (have) been ☐ approved by the examiner; ☐ disapproved by the examiner (see explanation).
11. ☐ The proposed drawing correction, filed _____, has been ☐ approved; ☐ disapproved (see explanation).
12. ☒ Acknowledgement is made of the claim for priority under U.S.C. 119. The certified copy has ☐ been received ☒ not been received
☐ been filed in parent application, serial no. _____; filed on _____.
13. ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.
14. ☐ Other

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15. Claims 7-10 are rejected under 35 U.S.C. § 112, first paragraph, for the reasons set forth in the objection to the specification.

The wording use in paragraph 3 of claim 7 is confusing in regards to the exact sequence of steps which the applicant wishes to claim with respect to the ashing step, and the neutralization step.

Claims 8-10 which depend on claim 7 are rejected for the same reasons as claim 7.

16. The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

17. Claims 1-10 are rejected under 35 U.S.C. § 103 as being unpatentable over Fujimoto et. al. further in view of Shinagawa et al.

Fujimoto et. al. disclose a process for patterning a Al film located on a barrier metal layer on a semiconductor substrate a beneath a patterned resist mask in a plasma comprised of a Cl-based gas. The resist layer and the corrosive Cl-residues remaining on the etched substrate are then removed in a chamber adjacent the etching chamber. Neutral particles extracted from a plasma are used to conduct both neutralization and ashing steps in order to reduce the amount of radiation damage that would have been done to the substrate as opposed to that which would have been done when a plasma is used instead. This is shown in figure 1, and discussed in columns 1-11. Fujimoto et. al. fail, however, to disclose the following aspects of applicant's claimed invention: the specific ashing process claimed by the applicant.

Shinagawa et. al. teach that it is desirable to ash a resist layer at a temperature of 180°C in the neutral particles extracted from a plasma comprised of O₂ and H₂O gasses. This is shown in figure 7; and discussed in the abstract; and in columns 4, 7, and 9.

It would have been obvious to one skilled in the art to replace the ashing step of Fujimoto et. al. with that taught by Shinagawa et. al. since this simply represents an alternative, and at least equivalent means for conducting the ashing step of Fujimoto et. al.

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18. Claims 20-22 are rejected under 35 U.S.C. § 103 as being unpatentable over Fujimoto, et. al. further in view of Galfo, et. al. and Nogami.

Fujimoto et. al. fail, however, to disclose the following aspects of applicant's claimed invention:

-the specific neutralization of the corrosive Cl-residues following the ashing of the resist layer along with a 3-chambered apparatus with separate chambers respectively dedicated for each of the following processes 1.) patterning an Al layer, 2.) ashing a resist mask, 3.) neutralizing corrosive Cl-residues in that order; and the specific construction claimed by the applicant for the post-treatment chamber.

Galfo et al. teach that it is desirable to employ two separate process steps for conducting the Cl-neutralization and resist ashing steps when patterning an Al layer on a semiconductor substrate. Both process steps are comprised of plasma treatment steps. This is discussed in columns 1-3.

Nogami teach the use of an apparatus capable of extracting charged particles from a plasma used to process a substrate. The neutral particles are then used to process a substrate. Nogami teach that it is desirable to use only the neutral particles in a plasma to process a substrate as opposed to the whole plasma in order to reduce the amount of radiation damage done to the substrate. This is shown; and discussed in the abstract.

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It would have been obvious to one skilled in the art to replace the single neutralization/ashing chamber taught by Fujimoto et. al. with two dedicated chambers each of which are capable of extracting the charged particles from a plasma before contacting the substrate with the plasma based on the following. First, Galfo et. al. teaches that it is desirable to conduct the patterning of an Al layer on a semiconductor substrate in 3 dry steps comprised of a Al etch step, a neutralization step, and a resist ashing step. Second, Nogami teach it is desirable to employ a plasma in which the charged particles have been removed from the plasma prior to contacting the substrate with the plasma in order to reduce the amount of radiation damage done to the substrate over that which would occur if such were not done. Third, it would have been obvious to one skilled in the art that it would have been desirable to replace the 1-step combination neutralization/ashing step of Fujimoto with a 2-step process in order to more effectively remove corrosive Cl-residues from the patterned Al substrate by optimizing each separate step for the respective processes which they are used to conduct (ie.- a Cl-neutralization step, and a resist ashing step) then would have been possible in a 1-step combination process. Fourth, it would have been obvious to one skilled in the art that it would have been

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desirable to employ separate treatment chambers for each of the process step taught above in the apparatus taught by Fujimoto et. al. in order to both increase the through put of the apparatus taught above as well as to decrease the risk of cross-contamination of the different process step with gasses used in the different steps over that which would occur in a 2-chambered process vessel as opposed to a 3-chambered process vessel when conducting a 3-step dry process. Fifth, it would have been obvious utilize a process vessel of the design taught by Nogami for both the Cl-neutralization and ashing chambers since this simply represents an alternative, and at least equivalent means for processing a substrate with only the neutral particles extracted from a plasma to that taught by Fujimoto et al in their second process vessel. Finally, it is irrelevant whether the neutralization step is conducted before or after the ashing step in the apparatus taught above based on In re Young, and In re Rishoi as cited below.

Furthermore, it is obvious to one skilled in the art that the configuration of the substrate worked upon by the apparatus claimed in this invention is not patentable in view of In re Young (25 U.S.P.Q. 69, 71 (CCPA 1935)) and In re Rishoi (94 U.S.P.Q. 71, 73 (CCPA 1952)). The Court of Customs and Patent Appeals stated in In re Young that inclusion of material worked upon by a machine as element in claim may not lend patentability, since claim is not otherwise allowable. Similarly, the Court of Customs and Patent Appeals stated in In re Rishoi that there is no patentable combination between a device and the material upon which it works.

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(Clearly, both the neutralization chamber, and the ashing chamber are interchangeable in that they both are capable of alternatively conducting the other process since they are of the same design. Thus, the sequence of process steps prescribed by the applicant in their apparatus claims has not patentably distinguished these claims over the prior art of record).

19. Claims 11-19 are allowable over the prior art of record.

20. Fukuyama et. al., and Tateiwa are cited of interest to the applicant.

Fukuyama et. al. teach the use of a H-containing plasma to remove Cl-residues from an Al layer etched in a Cl-based plasma.

Tateiwa teach the use of a multi-chambered apparatus for conducting an Al patterning process.

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner George A. Goudreau whose telephone number is (703) 308-1915.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0661.

George A. Goudreau
Goudreau/mm
September 16, 1992
September 29, 1992

BH
CHANCE HEARN
SUPERVISORY PRIMARY EXAMINER
ART UNIT 114